

Human capital and growth

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Set up

What means human capital?

- Pioneering work of Becker (1964), Nelson & Phelps (1966), Lucas (1988).
- Human capital: central concept to the economic analysis (growth and development) and for policy makers.
- Human capital: productive attributes of people in some economic context (educational attainment, skill, training ...) but also health, migrations (brain-drain), etc.

Human capital does affect growth through numerous channels. But, in a knowledge-based economy, technological progress is an important channel to create and absorb new technologies (R&D and innovation).

Set up

Investments in human capital

- Investment in education and learning by doing:
 - ▶ Education and skill of employees have an economic value for firms and for the economy as a whole.
 - ▶ Main question: does growth primarily driven by '**human capital accumulation**' or '**stock of human capital**' (Lucas Vs. Nelson & Phelps).
 - ▶ Policy implications differ according to each approach.
- Investment in health (health expenditures):

"... decline in the death is an indispensable prerequisite for modern economic growth" (Kuznets, 1973).
- Migration: 'brain-drain'.

Set up

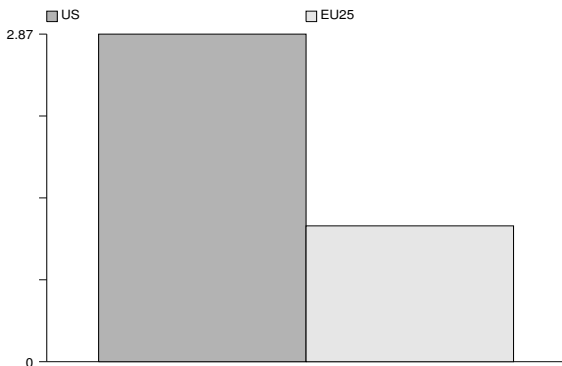
Why is so important: The EU policy context

- Title VIII of the Amsterdam Treaty: UE countries should promote a skilled and adaptable workforce.
- The Lisbon strategy (march 2000): EU Leaders committed the EU to become by 2010 “the most dynamic and competitive knowledge-based economy”.
- The Lisbon strategy revised (2005): strong emphasis on the need to invest more in **human capital** and **R&D**. Indeed, the observed slow productivity progress is due to the low investment in R&D and higher education.

Set up

Why is so important: The EU policy context

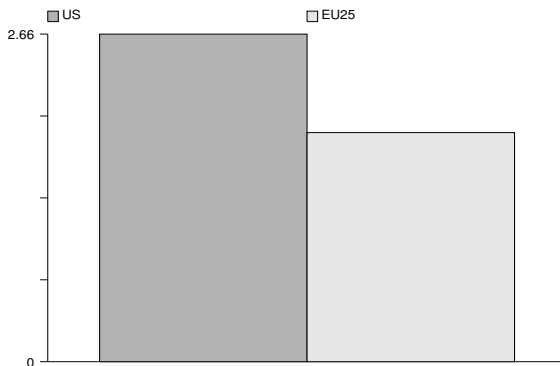
Expenditures on education as a % of GDP in tertiary education in 2003:
United-States Vs. European-Union 25



Set up

Why is so important: The EU policy context

R&D expenditures as a % of GDP in 2004:
United-States Vs. European-Union 25



Outline of the presentation

- 1 Set up
- 2 The puzzle of human capital
- 3 Education: 'accumulation' Vs. 'stock' of human capital
- 4 Human capital, R&D and technology diffusion
- 5 An introspection to health: the case of life expectancy
- 6 Some policy implications

The puzzle of human capital

Micro Vs. Macro empirics

- Benhabib & Spiegel (1994): hard task to find a robust empirical relationship between educational attainment and long-run economic growth.
 - ▶ Barro (2001): 0.0000 point estimate for the effect on growth of male upper school.
 - ▶ Islam (1995): “... *such ‘anomalous’ results are not new. Whenever researchers have attempted to incorporate the temporal dimension of human capital variables into growth regressions, outcomes of either statistical insignificance or negative sign have surfaced*”.
- Microeconomic evidence would imply the opposite (Becker, 1964; Hanushek, 1986; etc).
- Question: where has all the education gone? (Pritchett, 2001)

The puzzle of human capital

Reasons of the puzzle

- Human capital is not usually exchanged in markets like other economic goods.
- Measurements of human capital:
 - ▶ Indirect measure: educational attainments and/or enrolment rates.
 - ▶ Human capital indicators might not be very comparable at the cross-country level given the wide variety of educational systems around the world.
- de la Fuente & Doménech (2002); Cuaresma and Lutz (2008, IIASA) have partly addressed the data quality issue.

Education: 'accumulation' Vs. 'stock' of human capital

1. Human capital as 'accumulation' (Lucas): neoclassical approach

- ▶ Differences in growth rates across countries are mainly due to differences in the rates at which those countries accumulate human capital over time.
- ▶ Policy issues: should education be funded locally (privately) or nationally, ii) can education policies promote economic development?

2. Human capital as 'stock' (Nelson & Phelps): endogenous growth

- ▶ Describes growth as being driven by the **stock** of human capital which in turn affect a country's ability to **innovate** and catch up with more advanced countries.
- ▶ Policy issues: i) should governments emphasize primary/secondary or higher education, ii) should governments subsidize formal education Vs. on-the-job training, iii) should educational policy be elitist or broadly based.

Education: 'accumulation' Vs. 'stock' of human capital

The standard approach: accumulation of human capital

- Human capital as 'accumulation':
 - ▶ Human capital is an ordinary input in the production process, along with physical capital.
 - ▶ Skilled workers are more productive than non-skilled workers whatever the technology.
- Implications:
 - ▶ Such growth is nevertheless transitional because of decreasing returns to capital.
 - ▶ ... then, to sustain growth, it is necessary to keep on accumulating human capital.

Education: 'accumulation' Vs. 'stock' of human capital

Empirical evidence (cont'd)

- Barro & Sala-i-Martin (1995)
 - ▶ An extra year of higher level schooling (for males aged 25 and over) raises the growth rate on impact by 1.2% per year for countries all taken together.
 - ▶ A 1.5% increase of the ratio of public education spending to GDP (during the period 1965-1975) would have raised the average growth rate during the same period by 0.3% per year.
 - ▶ *'a 2% per capita growth rate seems to be about as good as it gets in the long run for a country that is already rich'.*

Education: 'accumulation' Vs. 'stock' of human capital

Empirical evidence

- Benhabib & Spiegel (1994)
 - ▶ Past education attainment (as a measure of the current stock of human capital) remains *uncorrelated* with growth if human capital is just an ordinary input in the aggregated production process.
 - ▶ The effect of past education attainment levels on current growth rates becomes *significant* in the Nelson and Phelps approach.
- Assumptions behind the findings
 - ▶ Growth is positively affected by the rate of **technological innovations** and by the **rate of adoption** of existing innovations.
 - ▶ The **stock** of human capital affects both these rates. Although the correlation coefficient is essentially zero (or even negative) in the former case, it becomes positively significant (about 1.2) in the latter case.

These findings support the alternative approach: human capital as primary source of innovations.

Human capital, R&D and technology diffusion

Human capital as primary source of innovations.

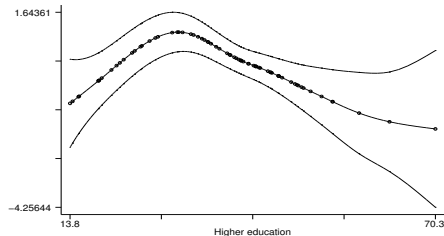
The alternative approach: testable predictions

- Productivity growth and the rate of innovations should increase with the **level** of education attainment.
 - ▶ Evidence: significant impact of the **level** of secondary and higher education attainment on the growth rate of productivity (see Barro & Sala-i-Martin, Benhabib & Spiegel).
- The marginal productivity of education attainment increases with the rate of technological progress.
 - ▶ **Complementarity** between education and R&D activities (Bartel & Lichtenberg, 1987).
- Education as a vector for **technological catch-up** via innovation.
 - ▶ Evidence: effect of past educational attainment levels on current growth.

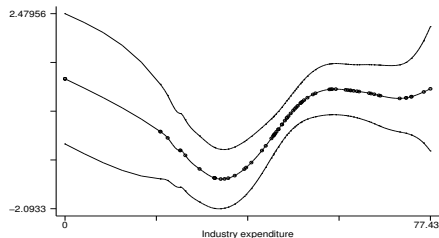
Human capital, R&D and technology diffusion

Example: technology frontier, labor productivity and growth (Azomahou & Diene)

Labor productivity backwardness and school enrollment rate in higher education



Labor productivity backwardness and the share of R&D expenditure in % of gross domestic expenditure on R&D as a % of GDP funded by industries



An introspection to health

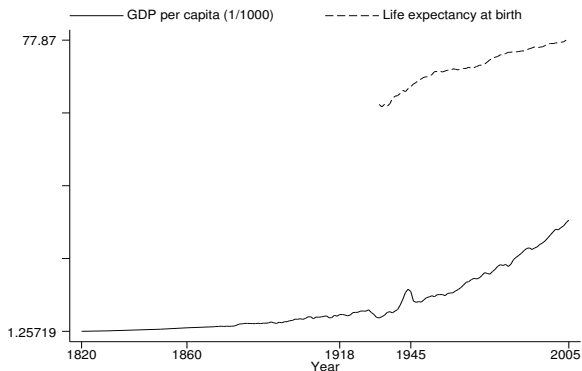
Example: The relationship between life expectancy and economic growth (Azomahou, Boucekkine, Diene)

- Armatya Sen (1998): '*... the forces that contribute to an increase or a reduction of **mortality** often have economic causes*'.
- **Life expectancy** in a country is a broad measure of population health.
- Health expenditures
 - ▶ Most of developed countries spent a rising share of total economic resources on health and enjoyed substantially longer lives.
 - ▶ World Bank (1998): life expectancy displays a strong tendency to improve with per capita income (feedback effect).
 - ▶ Ben-Porath mechanism: increasing life expectancy leads people to lengthen schooling time, and then to become more productive.

Life expectancy and economic growth

Azomahou, Boucekkine, Diene (forthcoming)

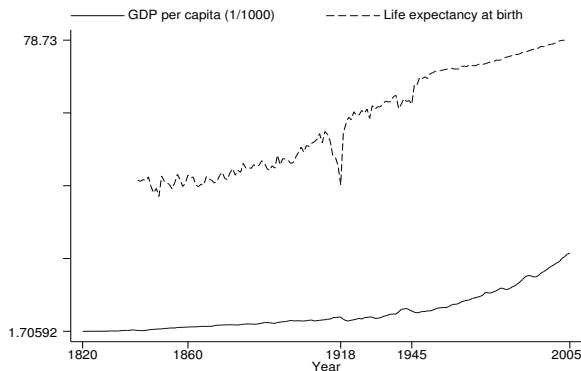
Co-evolution of GDP per capita and life expectancy at birth: US



Life expectancy and economic growth

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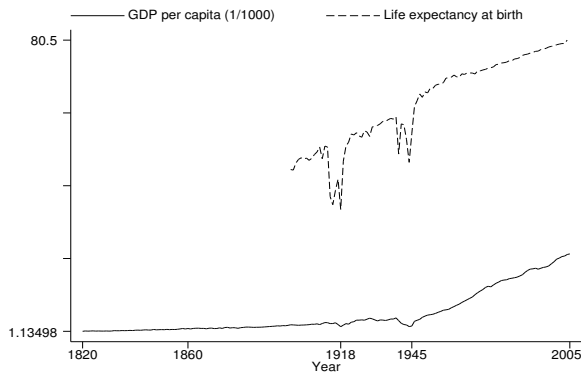
Co-evolution of GDP per capita and life expectancy at birth: United Kingdom



Life expectancy and economic growth

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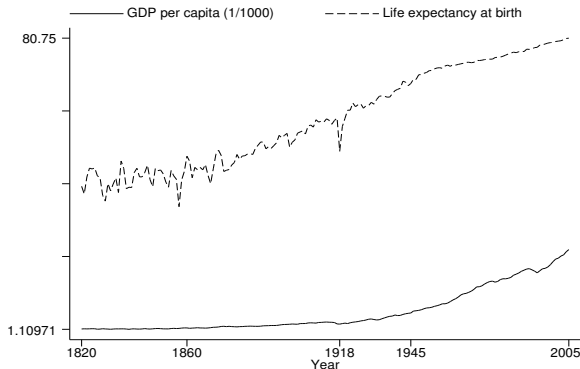
Co-evolution of GDP per capita and life expectancy at birth: France



Life expectancy and economic growth

Azomahou, Boucekkine, Diene (forthcoming)

Co-evolution of GDP per capita and life expectancy at birth: Sweden



An introspection to health: The relationship between life expectancy and economic growth

- Growth engine: **human capital accumulation**

- ▶ A higher life expectancy is likely to lengthen the schooling time, thus inducing a better education and better conditions for economic development.
- ▶ ... but at the same time, the fraction of people who did their schooling a long time ago will rise, implying a negative effect on growth, which may be even worse if we account for voluntary retirement.
- ▶ Overall, the effect of increasing longevity on growth is ambiguous, and much less simple than the common view.

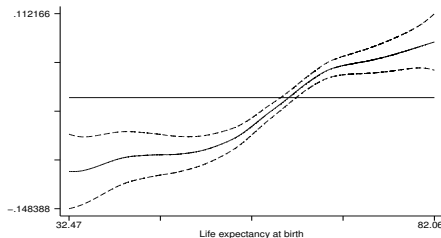
Life expectancy and economic growth

Azomahou, Boucekkine, Diene (forthcoming)

Theory:
hump-shaped relationship
(human capital accumulation engine)



New empirical evidence:
convex-concave relationship
(age-dependent mortality accounted for)



Some policy implications

1. Life expectancy and economic growth:

- ▶ Because people with different ages have different lifetimes, they will have different *effective* planning horizons, and notably different saving decisions.
- ▶ Is the growth of health spending a rational response to changing economic conditions, notably the growth of income per person? (Hall & Jones, 2007)

2. Macrofoundations of education policy:

- ▶ Governments will increase the average level of education, not only directly through education policy, but also indirectly by actively supporting R&D activities.
- ▶ Governments subsidies to education will increase the profitability of research and development activities, and thereby speed up technological progress.